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Keller

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(54) **INSTRUMENTATION FOR INSERTION OF AN INTER-VERTEBRAL PROSTHESIS**

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Jun. 10, 2002 (DE) 102 25 703

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A61B 17/60 (2006.01)
A61F 2/00 (2006.01)

(52) **U.S. Cl.** **606/99**

(58) **Field of Classification Search** ..... 606/90, 606/99, 86 A, 105, 205–208, 914; 81/302, 81/312

See application file for complete search history.

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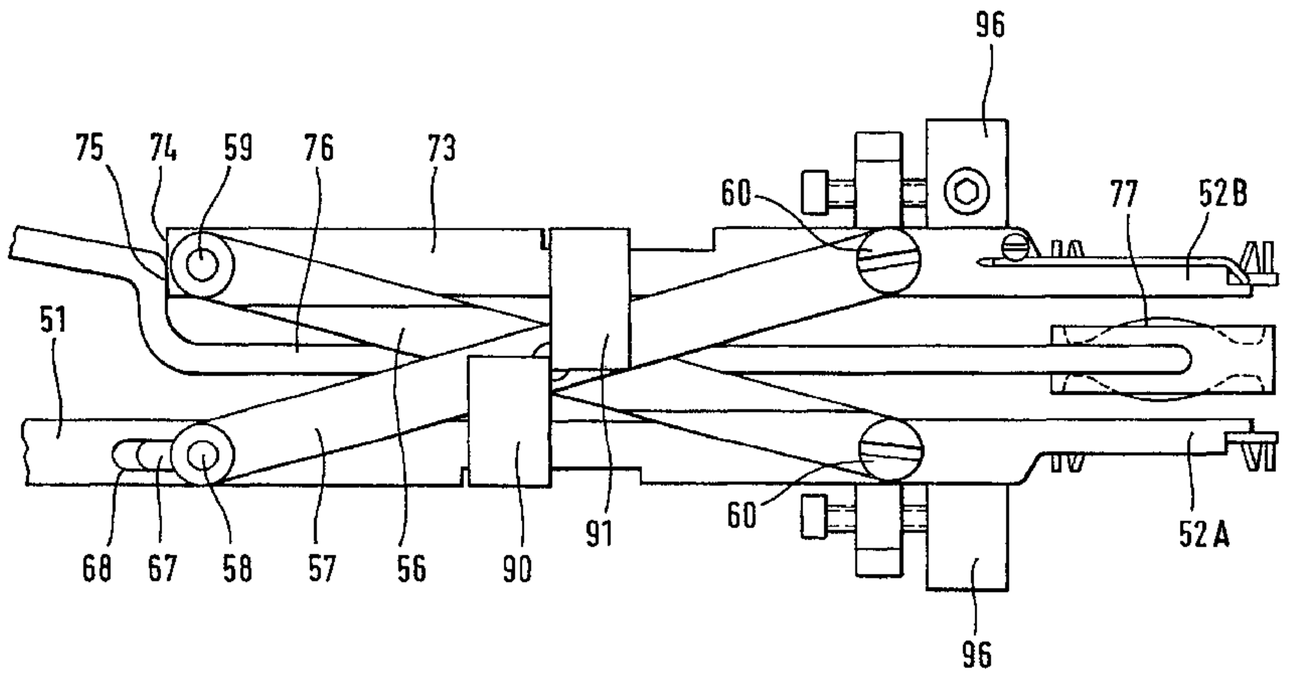
(57) **ABSTRACT**

An instrument for inserting an intervertebral prosthesis, comprising two prosthesis holders which are connected by a parellel guide and can be spread apart from one another and are intended to receive a pair of prosthesis plates. The first prosthesis holder is arranged fixedly on an elongate instrument body. The second prosthesis holder is held from the instrument body by means of a parallel guide. The parts connecting the second prosthesis holder to the instrument body or to the first prosthesis holder delimit on both sides a central through-opening which extends like a channel in the longitudinal direction of the instrument body and whose width corresponds at least to the transverse dimensions of a prosthesis core, to be inserted between the prosthesis plates, and of the prosthesis core holder provided for this.

18 Claims, 7 Drawing Sheets



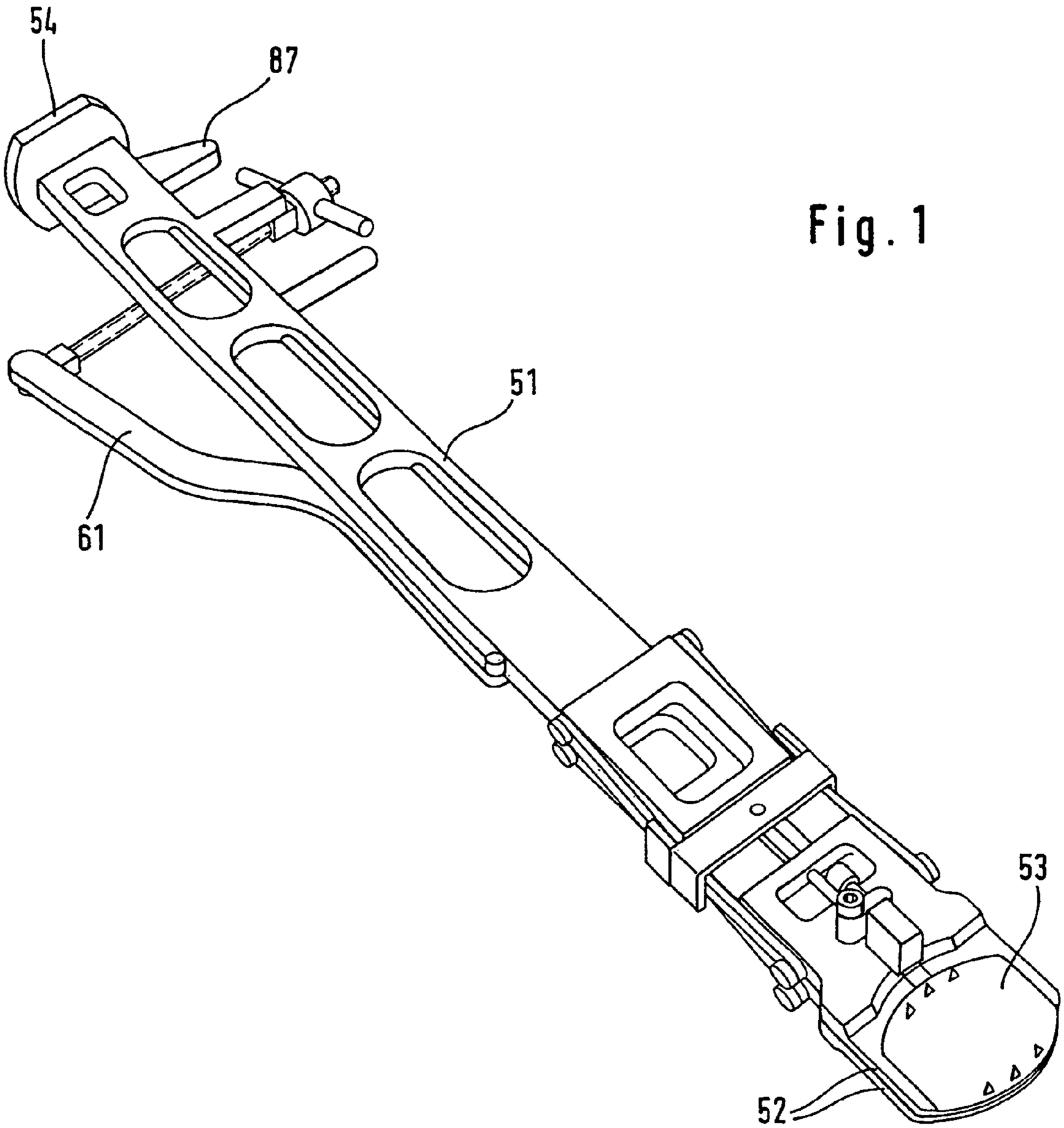


Fig. 1

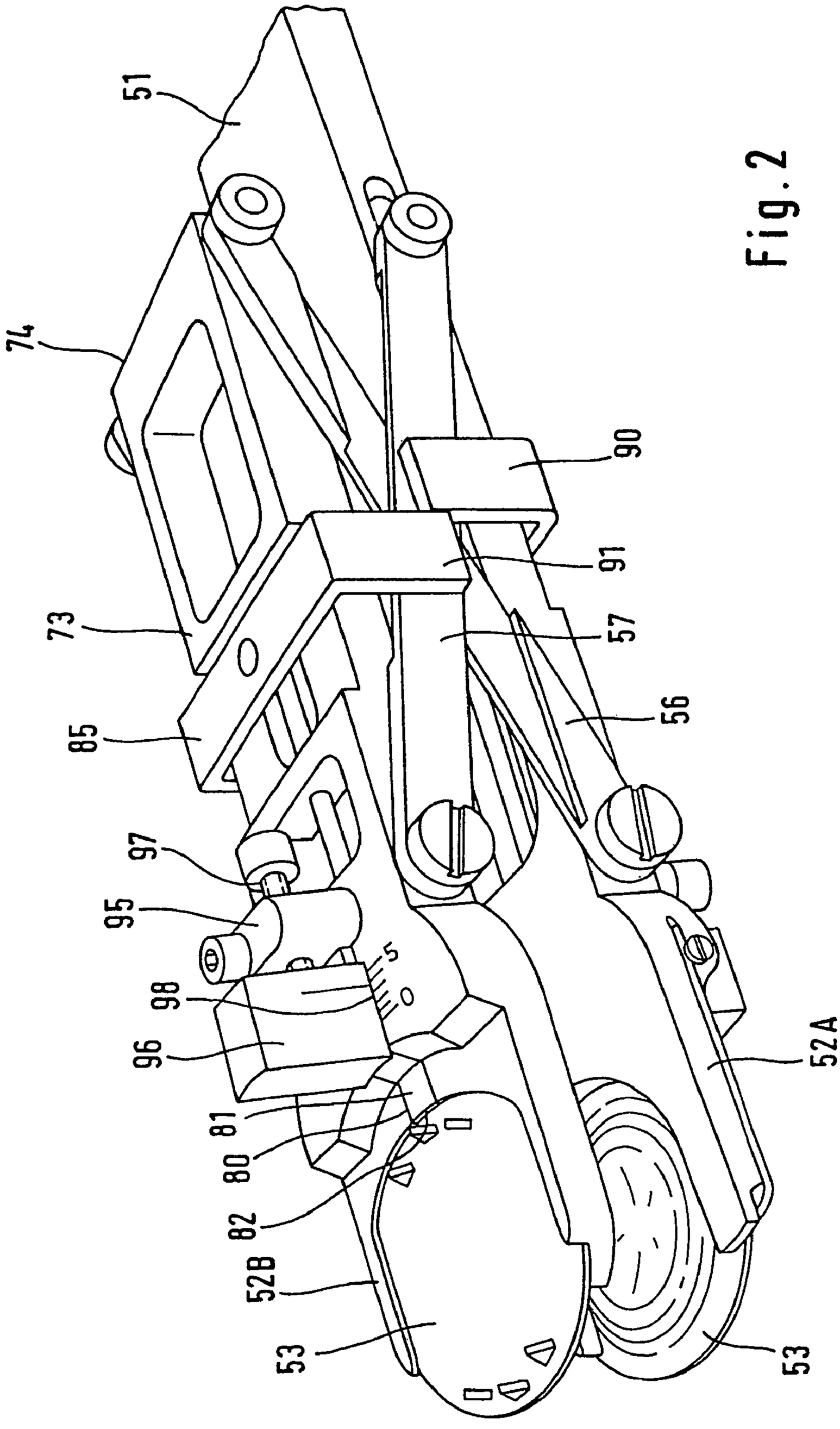


Fig. 2

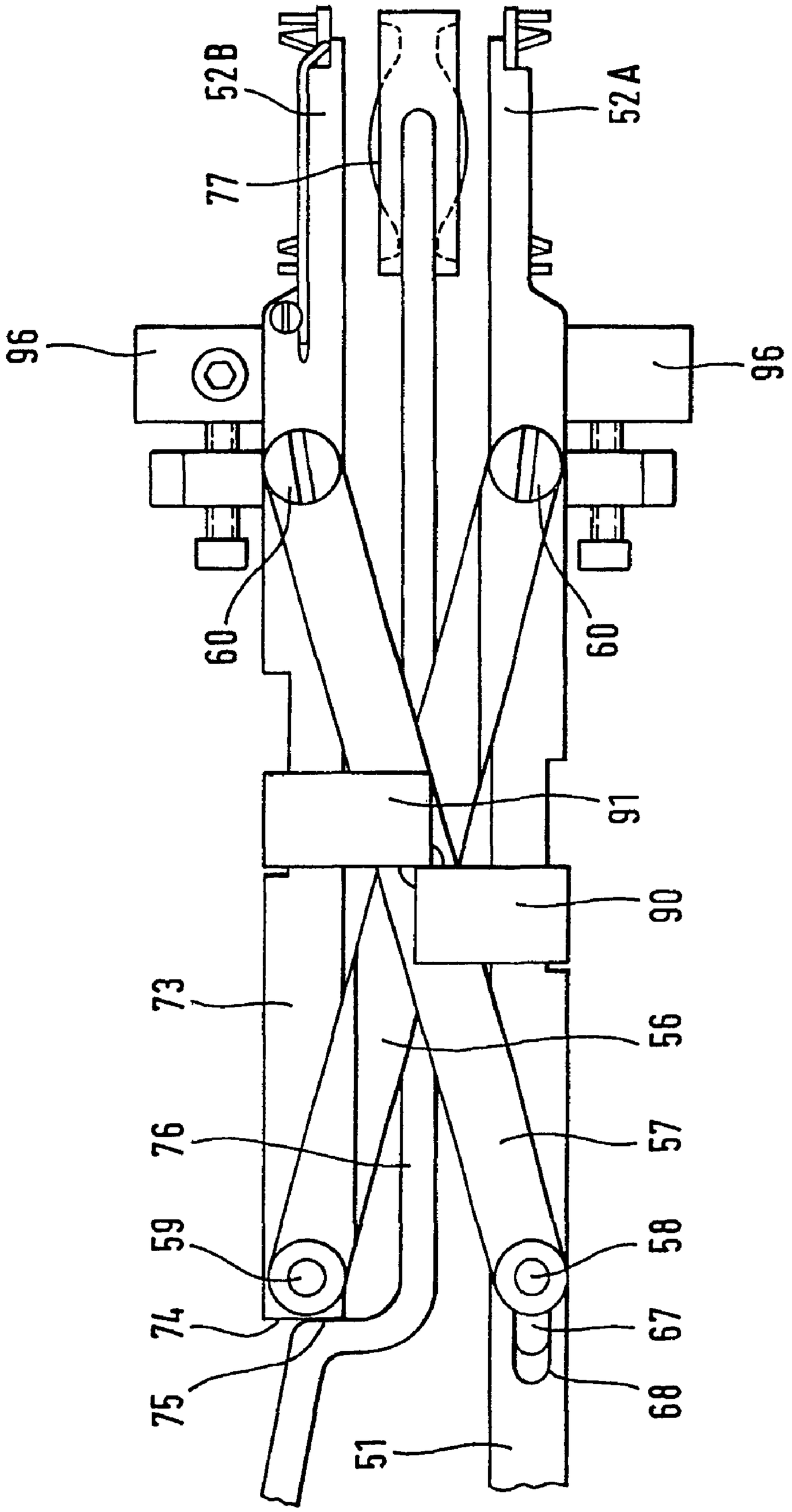
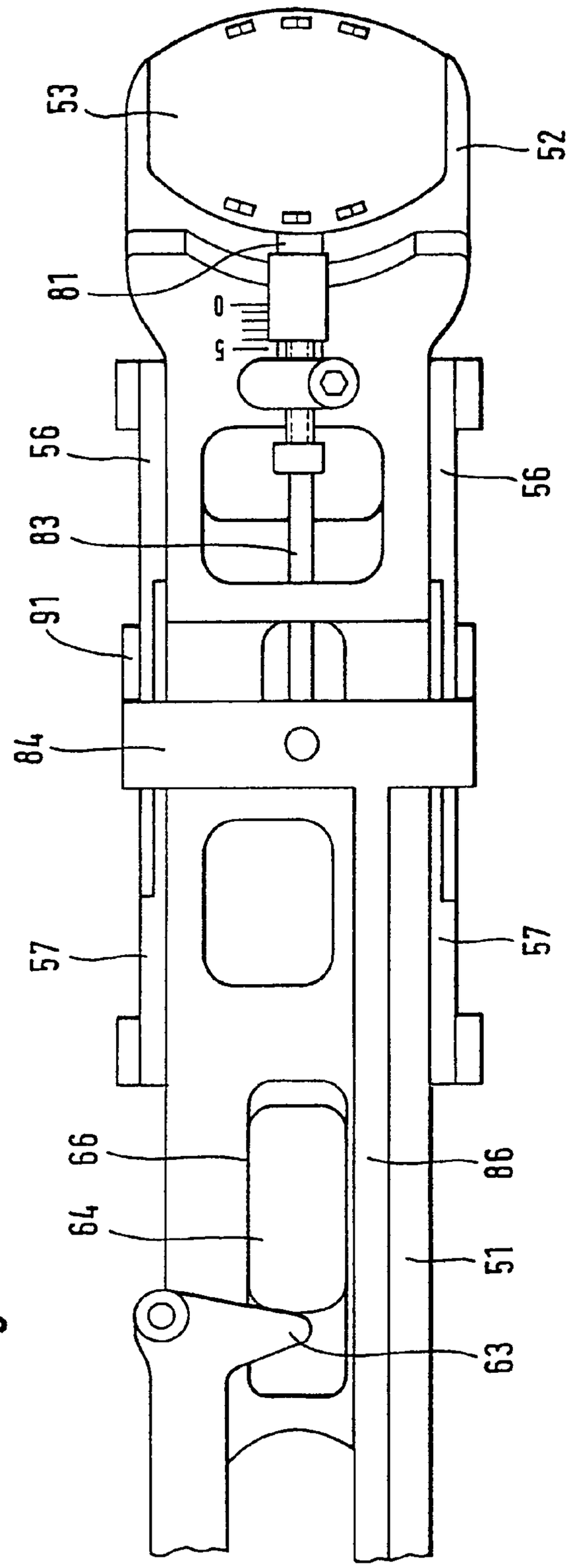


Fig.3


53
52
81
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5
56
56
83
91
84
57
57
66
86
64
51
63

Fig. 4

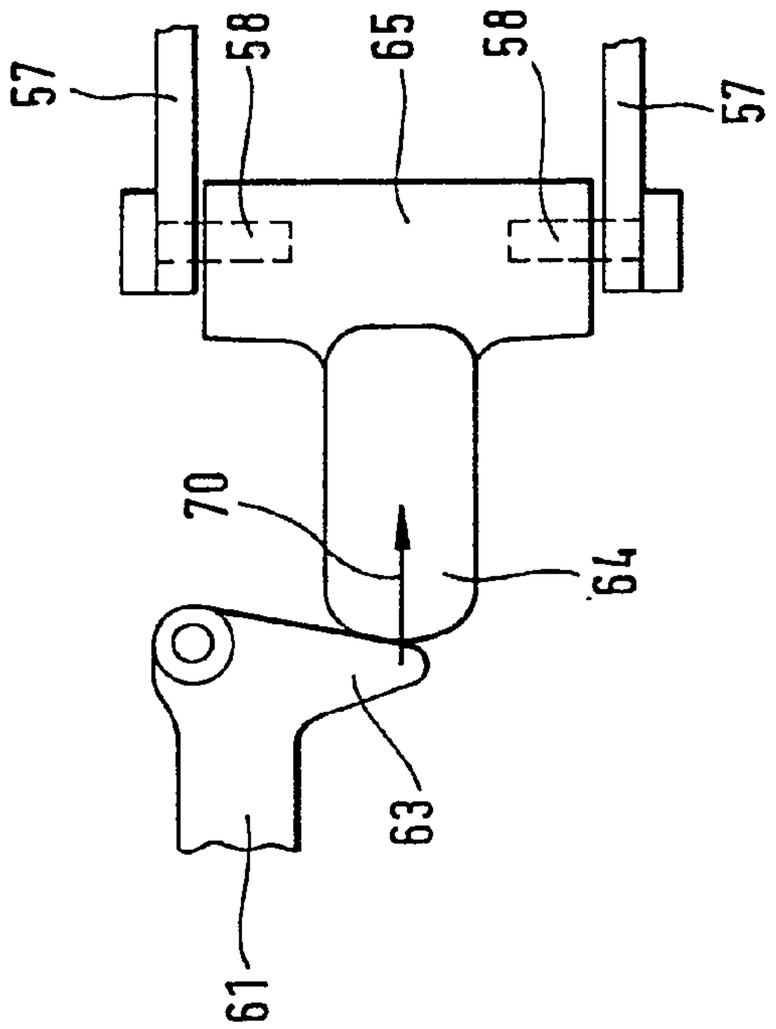
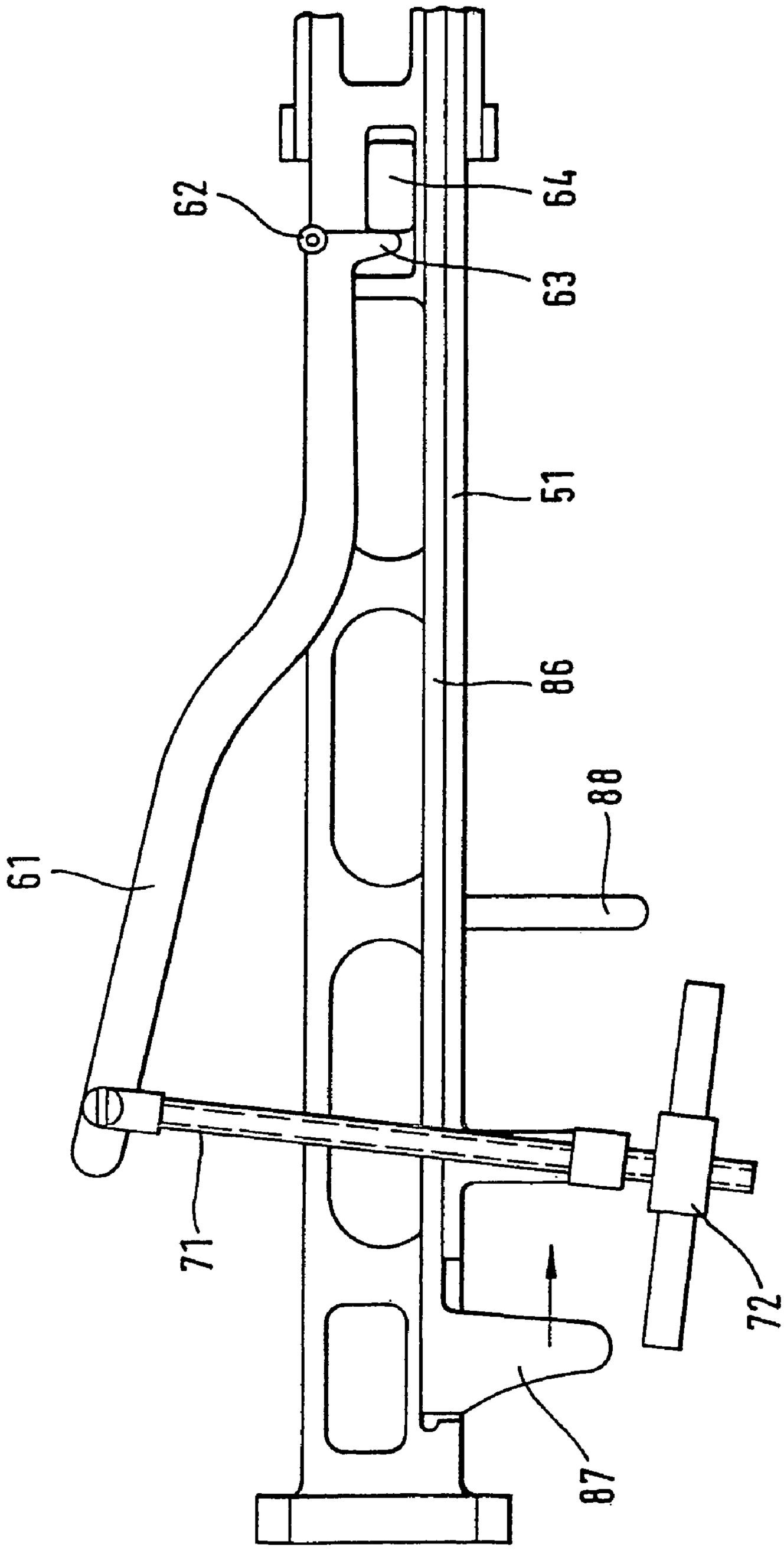

57
58
65
58
57
70
64
63
61

Fig. 6

Fig. 5



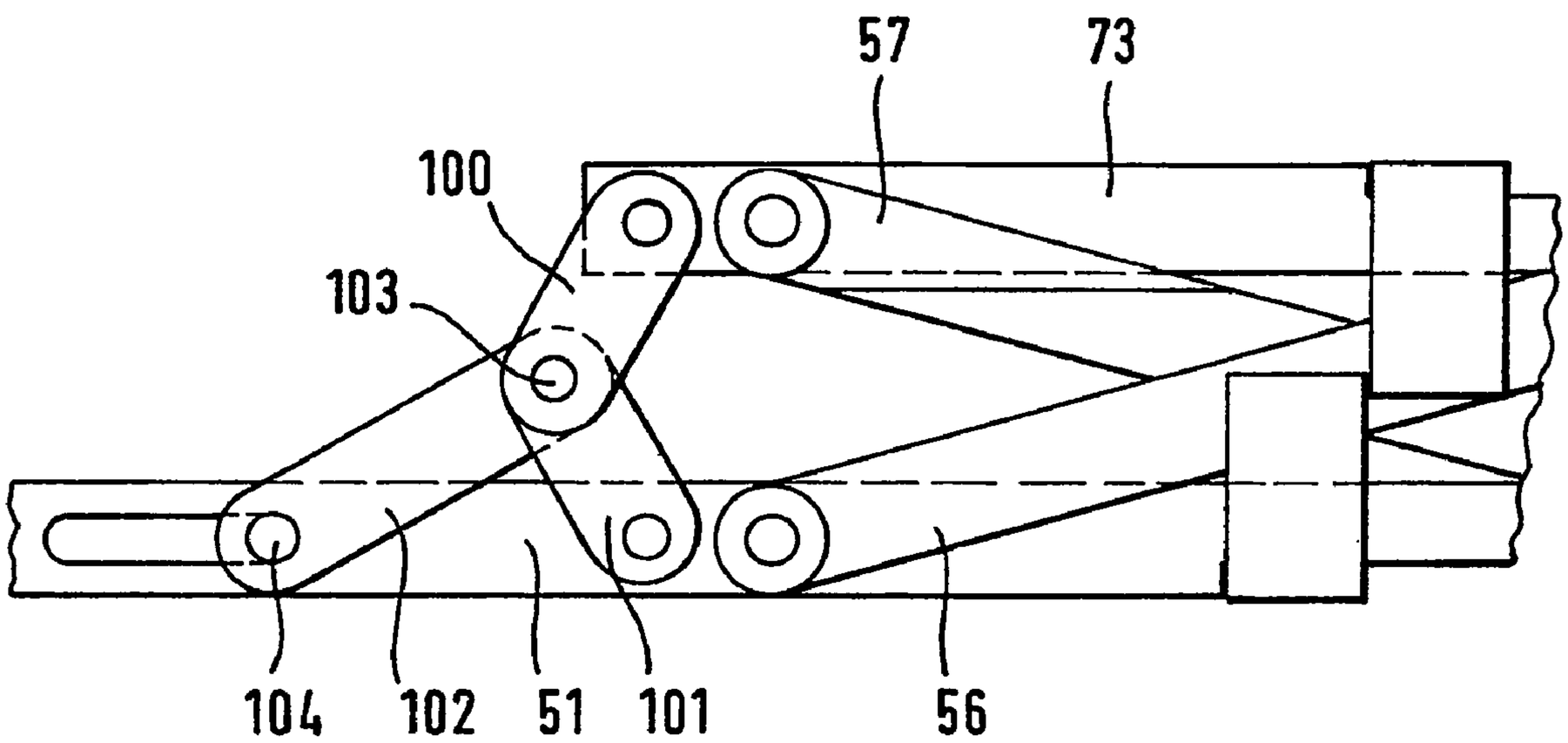


Fig. 7

Fig. 8

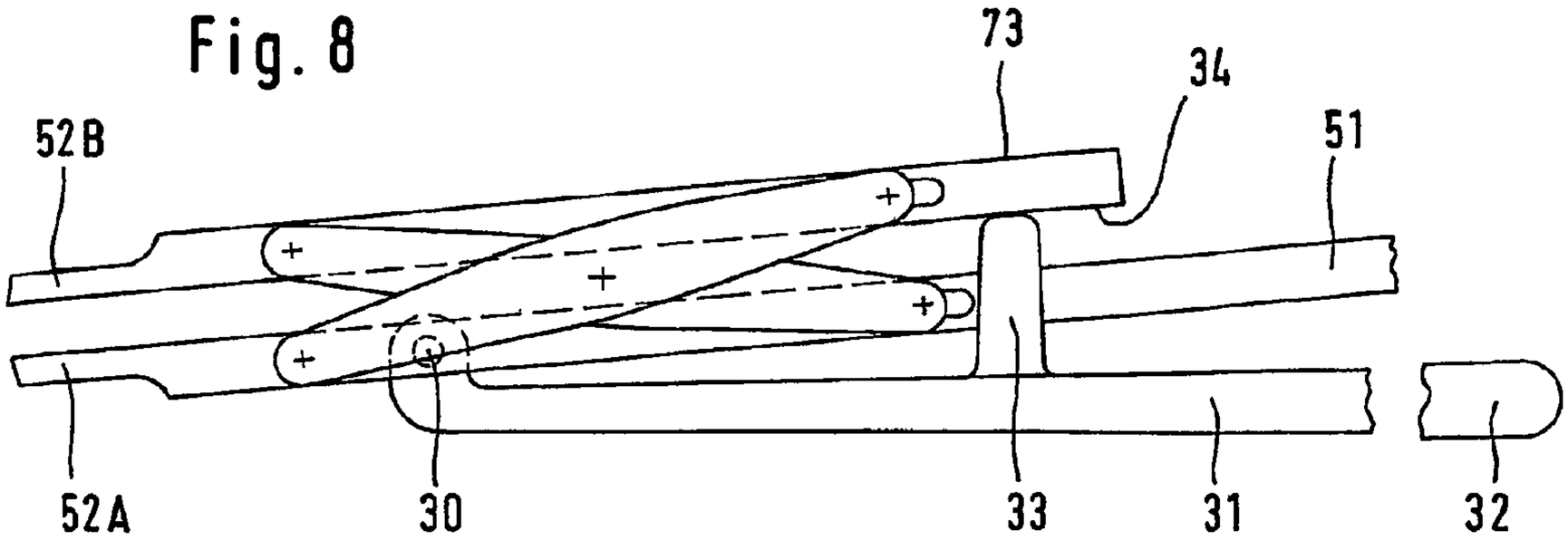


Fig. 9

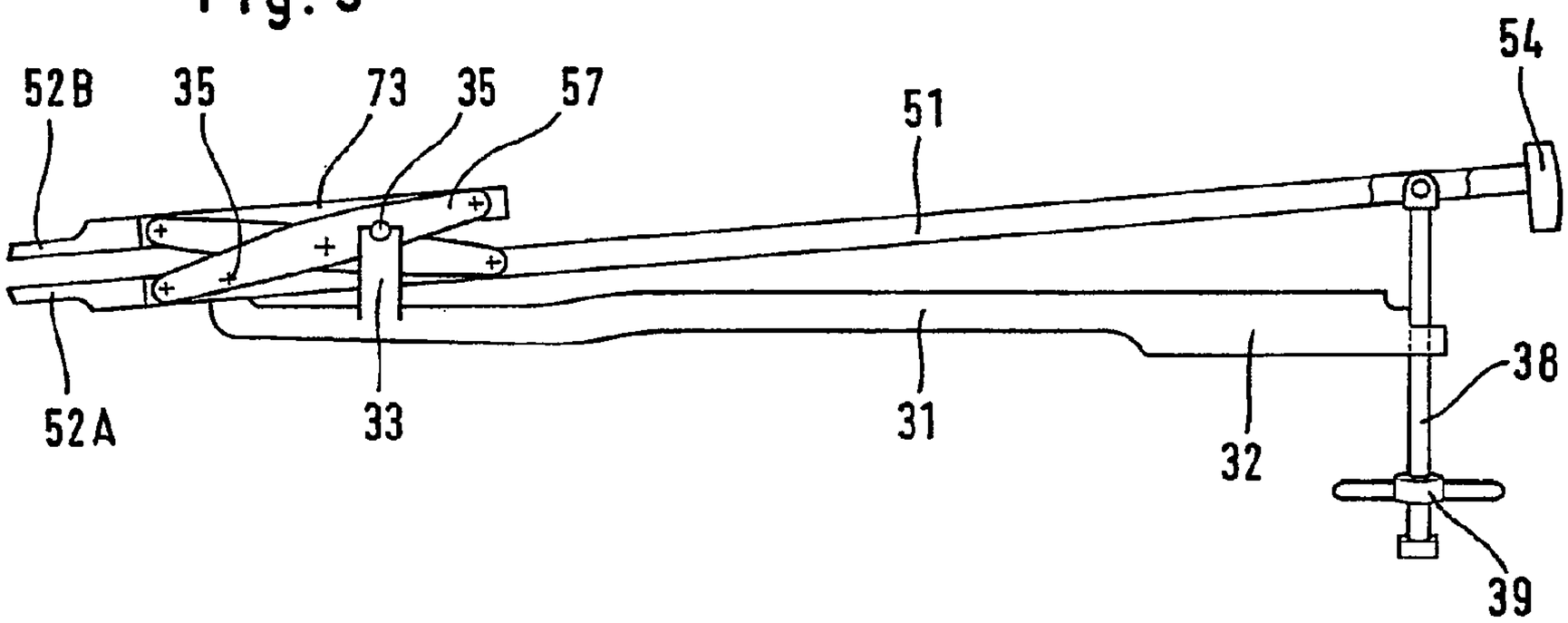
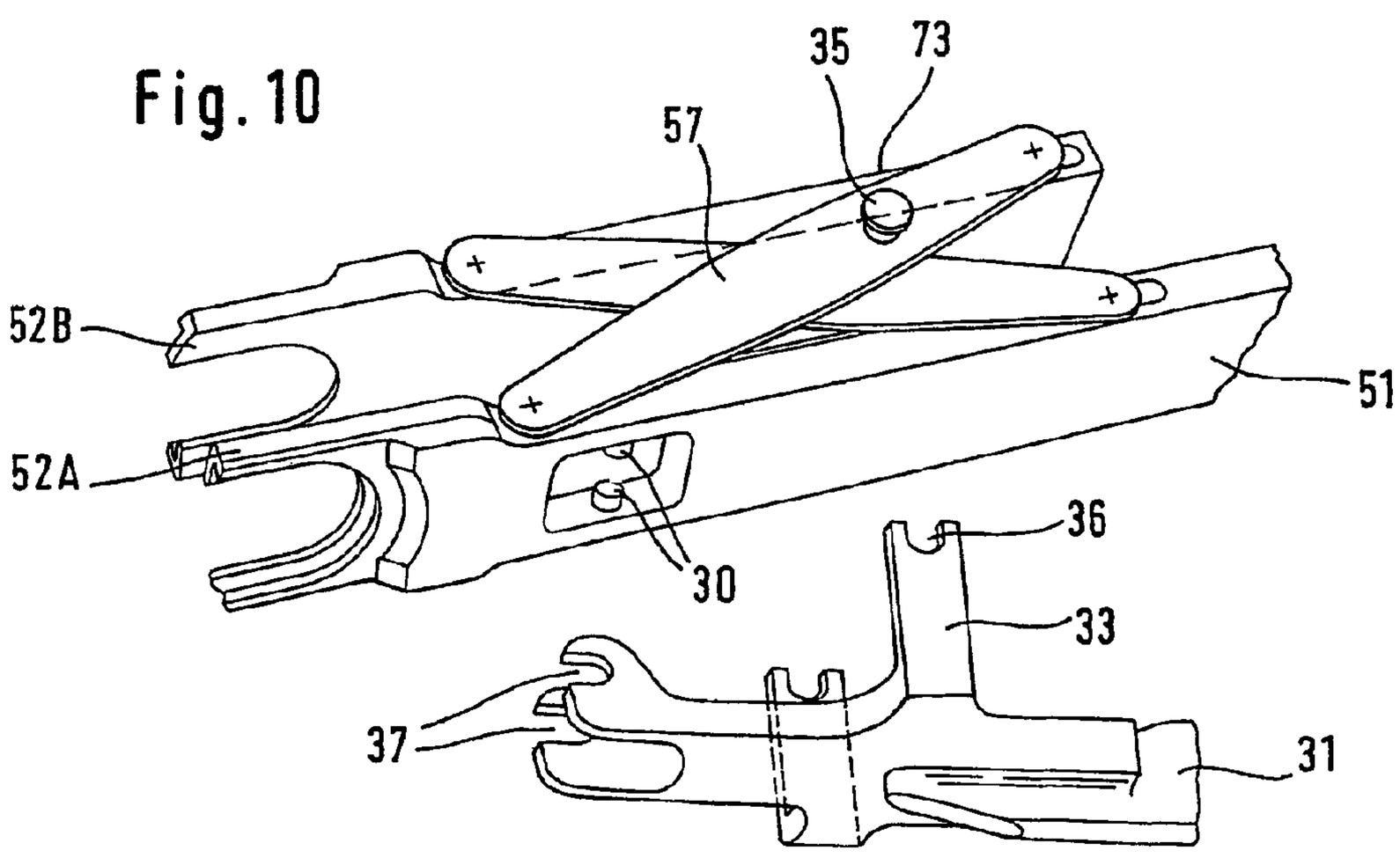


Fig. 10



INSTRUMENTATION FOR INSERTION OF AN INTER-VERTEBRAL PROSTHESIS

BACKGROUND OF THE INVENTION

To insert intervertebral prostheses consisting of two prosthesis plates, each to be connected to a respective vertebral body, and of a prosthesis core arranged between these plates, insertion instruments are known (EP-A-333 990) which, at their front end, have two prosthesis holders which each receive a prosthesis plate. The prosthesis holders are connected to one another via a parallel guide which makes it possible initially to bring the prosthesis plates very close to one another, so as to be able more easily to introduce them into the narrow intervertebral space, and then to spread them apart (with the adjoining vertebrae) in order to be able to insert the prosthesis core between them. Thereafter, the prosthesis holders are moved back toward one another so that the prosthesis plates receive the prosthesis core in its operational position, and the instrument is removed. The known instrument is designed as a forceps which is angled in relation to the direction of the prosthesis holders, which direction is intended to coincide with the median direction of the body, so as not to impede the introduction of the prosthesis core. Nevertheless, the introduction of the prosthesis core is difficult.

An instrument for introducing a prosthesis of this kind is also known (DE-U-299 16 078) which is formed by a lower pair of guide rods and an upper guide rod, these rods being articulated on one another at the rear end and carrying prosthesis holders at their front ends. They form a guide track for a spreader element. When the latter is driven forward between them by means of a toothed rack, it spreads the rod ends apart and at the same time pushes the prosthesis core ahead of it until the latter has reached the desired end position. Thereafter, the spreader element is drawn back in order to bring the prosthesis plates toward the prosthesis core. In this case, the spreading movement is inextricably linked with the introduction of the prosthesis core, so that the spreading operation is not separate from the introduction of the prosthesis core and can be observed only with difficulty.

SUMMARY OF THE INVENTION

The object of the invention is to make available an instrument which permits spreading of the prosthesis plates independently of the introduction of the prosthesis core, but which still facilitates said introduction of the prosthesis core.

The solution according to the invention lies in the features of claim **1**.

It relates to an instrument for inserting an intervertebral prosthesis, comprising two prosthesis holders which are connected by a parellel guide and can be spread apart from one another and are intended to receive a pair of prosthesis plates. The first of these prosthesis holders is arranged fixedly on an elongate instrument body so as to lie in the longitudinal direction of the latter. The second prosthesis holder is held on the instrument body by means of the parallel guide. All the parts connecting the instrument body and the second prosthesis holder are arranged outside a central through-opening which extends in the longitudinal direction of the instrument body and whose width corresponds at least to the transverse dimensions of the prosthesis core, to be inserted between the prosthesis plates, and of a prosthesis core holder provided for this. In this way, the prosthesis core can be easily introduced with the aid of a prosthesis core holder through the insertion instrument, whose elements on both sides form a guide for the prosthesis core or prosthesis core holder. To ensure that the operating surgeon, when introducing the prosthesis core, can easily detect the position of the prosthesis core holder at which the prosthesis core has reached the desired position between the prosthesis plates, the insertion instrument and the prosthesis core holder are expediently provided with interacting limit stops which determine this end position.

For actuation, an oblique link arm can be provided whose first end is mounted on the instrument body so as to be movable in the longitudinal direction thereof. Its second end is mounted on the second prosthesis holder with a fixed axis. Its first end is connected to an actuating device which is movable in the longitudinal direction of the instrument body. When the actuating device is moved in the direction in which the first end of the oblique link arm is moved in the direction toward the hinge point of its second end, the oblique link arm straightens and thus spreads the second prosthesis holder away from the instrument body and the first prosthesis holder, and vice versa.

The oblique link arm can be part of a scissor-type parallel guide. The oblique link arm is expediently provided in a pair symmetrically on both sides of the instrument body, in order to avoid a force transmission which is asymmetrical and tends to cause tilting.

The actuating device expediently comprises a handle and a transmission device. The transmission device can, for example, be formed by a threaded spindle. It has proven expedient to design the actuating device as a grip lever which is connected to a shorter working lever forming the transmission device. It is expediently arranged in such a way that it at the same time converts the lateral movement of the grip lever into the actuating direction extending in the longitudinal direction of the instrument body.

The oblique link arm can be mounted with its first end on a slide which is guided on the instrument body in the longitudinal direction thereof. Instead of this, it is also possible for the oblique link arm to be a member of a toggle lever pairing, in which case the actuating device acts directly or indirectly on the toggle point of the lever pairing.

In another embodiment of the invention, an actuating device is provided which comprises an actuating lever which is mounted at its front end on the instrument body or the first prosthesis holder so as to pivot. The pivot axis extends transversely with respect to the longitudinal direction of the instrument body and to the direction of spreading. Behind this axis, the lever has a limit stop which acts directly or indirectly on the second prosthesis holder. At the rear end, the lever is designed such that it can be operated by hand. In the unspread state of the instrument, the lever is at a certain angular distance from the instrument body. If it is pulled by hand, or by suitable aids such as a threaded spindle, toward the instrument body, the limit stop moves the second prosthesis holder away from the first prosthesis holder and in this way spreads them apart. By virtue of the lever action, great spreading forces can be transmitted. In a preferred embodiment of the invention, the limit stop acts on an oblique link arm connected to the second prosthesis holder, which oblique link arm can also be part of the parallel guide. The lever is expediently not an integral part of the instrument body, and instead it is designed in such a way that it can be easily attached to the instrument body and released again from the latter during the operation. This has the advantage that the instrument body is not weighed down by the spreader mechanism, formed by the lever, in those stages of the operation when spreading does not take place or does not have to be maintained. This actuating device may merit protection independently of the features of the claims.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention is explained in greater detail below with reference to the drawing which depicts an advantageous illustrative embodiment. In said drawing:

FIG. **1** shows an overview of the instrument,

FIG. **2** shows a perspective view of the front portion of the instrument, obliquely from above,

FIG. **3** shows a side view of the front portion,

FIG. **4** shows a bottom view of the front portion,

FIG. **5** shows a bottom view of the rear part of the instrument,

FIG. **6** shows a detail of the actuating device,

FIG. **7** shows a second design of the spreader device,

FIG. **8** shows a third design of the spreader device,

FIG. **9** shows a variant of the third design of the spreader device, and

FIG. **10** shows a detail of the actuating lever used for this.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

At the front end of the instrument body **51** there are two holders **52** for prosthesis plates **53**. The prosthesis holders **52** are fork-shaped and open at the end. Their side branches form guides for the edge of the prosthesis plates **53**. Their direction coincides with the longitudinal direction of the instrument body. They allow the prosthesis plates to overcome a frictional force and be inserted easily into the prosthesis holders **52**, and removed therefrom, in the longitudinal direction of the instrument. At the rear end, the prosthesis body **51** has a strike plate **54**. By striking this plate, the prosthesis plates **53** held by the prosthesis holders **52** can be driven in between two vertebral bodies.

The lower prosthesis holder **52**A (FIGS. **9** and **10**) is fixedly connected to the instrument body **51**, and in the example illustrated is even made integral therewith. The upper prosthesis holder **52**B is connected to the instrument body **51** via a scissor arrangement consisting of scissor members **56**, **57**. The scissor arrangement **56**, **57** is provided as a pair on both sides of the instrument body and is designed in such a way that the upper prosthesis holder **52**B can move exclusively perpendicular to the lower prosthesis holder **52**A and parallel to it. The prosthesis holders can be brought very close to one another (FIG. **1**) so that it is easier to drive them into the intervertebral space. They can be spread apart (FIGS. **2** and **3**) together with the adjoining vertebral bodies in order to create space for introducing the prosthesis core **77** between the prosthesis plates **53**. They are then brought back toward each other in order to secure the prosthesis core in the desired position. The instrument can then be removed.

The rear pins **58**, **59** of the scissor members **56**, **57** slide in oblong holes of the instrument body **51** or of the plate **73** which continues the upper prosthesis holder **52**B to the rear. The direction of the oblong holes coincides with the longitudinal direction of the instrument. The front pins **60** of the scissor members **56**, **57** are rigidly connected to the prosthesis holders **52**. In order to spread the prosthesis holders, a device is provided which moves the rear pin **58** of the scissor member **57** in the longitudinal direction of the instrument. For this purpose, the grip lever **61** is provided which is pivotable on the instrument body about an axis **62** and has a working lever **63** acting on the rear end of a slide block **64**, which is part of a T-shaped slide **65** (FIGS. **4** and **6**) on whose crosshead the rear pins **58** of the scissor members **57** arranged on both sides are articulated. The slide **65** is guided in the longitudinal direction of the instrument body. It will be seen in FIG. **4** that the parallel edges of the slide block **64** are guided between correspondingly parallel edges **66** of a cutout in the instrument body. It will be seen in FIG. **3** that the ends **67** of the crosshead are guided in oblong holes **68**. When the grip lever **61** is pulled toward the instrument body, as when pressing together the levers of a forceps, its working lever **63** pushes the slide **64** in the arrow direction **70** (FIG. **6**). In this way, the rear end of the scissor member **57** is driven forward, as a result of which the prosthesis holders **52** are spread apart from one another. The working lever **63**, the slide **65** and the oblique link arms **57** thus form an arrangement for adjusting the distance between the prosthesis holders **52**. It will be appreciated that this arrangement can also be replaced by other designs. It will also be noted that the spreading force does not necessarily have to be exerted via parts of the scissor arrangement.

If the angle between the oblique link arm **57** and the longitudinal direction of the instrument is too small for exerting a substantial spreading force, a separate member can be provided for the spreading. This alternative is illustrated in FIG. **7**. The plate **73**, which at its front end supports the upper prosthesis holder **52**, is supported, as in the above-described illustrative embodiment, by means of a scissor arrangement **56**, **57** on the instrument body **51**. In a departure from this design, the spreading device is made independent of the scissor arrangement. The link arms **100**, **101** form a toggle lever arrangement. One end of these link arms is connected to the instrument body **51** or the plate **73**. Their other end forms the toggle **103**, on which the end of a link arm **102** engages whose other end **104** is connected to the actuating device. The connection can be configured as shown in FIG. **6**. The spreading arrangement independent of the scissor arrangement **56**, **57** has the advantage that the angles at which the link arms **100**, **101** and **102** are stressed can be dimensioned solely for favorable force transmission and without taking into account a parallel guide function.

Considerable forces arise when the prosthesis holders are spread apart. For this reason, the grip lever **61** is supplemented by a threaded spindle **71** with butterfly nut **72**, which makes the procedure easier and allows the instrument to be fixed temporarily in the spread position.

In this position, a channel-like free space is formed between the instrument body **51** and the plate **53** continuing the upper prosthesis holder **52** rearward, on the one hand, and between the lateral scissor arrangements **56**, **57** on the other hand. Using an instrument **76** guided between the link arms **56**, **57**, the prosthesis core **77** can be guided through this free space between the prosthesis plates **52** (FIG. **3**). The instrument **76** has a limit stop **75** which bears on the rear edge **74** of the plate **73** when the prosthesis core **77** has exactly reached the intended position between the prosthesis plates **52**.

A device is now described which is used to eject the prosthesis plates **53** from the prosthesis holders **52** and to force the instrument away from the prosthesis holders and the adjoining vertebrae. Behind the receiving area for the prosthesis plates **53**, the prosthesis guides **52** contain a guide groove **80** which extends in the longitudinal direction of the instrument and thus in the direction of sliding of the prosthesis holders **52**. It includes a slide **81** whose front end **82** strikes against the edge of the prosthesis plate located in the prosthesis holder and is therefore referred to as a prosthesis limit stop. The rear end (not visible in FIGS. **2** and **3**) of the slide **81** is rigidly connected to rods **83** likewise guided in the longitudinal direction of the instrument. The rear end of the rod **83** mounted in the instrument body **51** is, as shown in FIG. **4**, secured on a limit stop element **84** whose nature will be explained later. It is also displaceable in the longitudinal

direction of the instrument. The limit stop element **84** is in turn rigidly connected to a push rod **86** which is mounted so as to be longitudinally displaceable in the instrument body **51** and leads to a handle **87**. When the operating surgeon pushes the handle **87** forward in the direction of the arrow, the push rod **86**, the limit stop element **84**, the rod **83** and the slide **81** are moved forward in order to push the prosthesis plate **53** out of the prosthesis holder **52**. In doing so, the operating surgeon's hand can be supported on a projection **88** which is fixedly connected to the instrument body **51**.

The movement of the handle **87** acts directly only on the slide **81** which is arranged in the lower part of the instrument, namely in the instrument body. To ensure that the slides **81** of both prosthesis holders move in synchrony, a movement-transmitting device is provided. The rod **83** controlling the slide **81** of the upper prosthesis holder is fixedly connected at its rear end to a limit stop element **85** which, like the limit stop element **84** of the lower prosthesis holder, is guided movably in the longitudinal direction of the instrument. The lower limit stop element **84** has, on both sides, upwardly extending limit stop branches **90** which lie behind and adjacent to the branches **91** which extend downward on both sides from the upper limit stop element **85**. When the prosthesis plates **53** are located in their rearmost position in the prosthesis holders **52**, and the prosthesis limit stops **82** touch them, the mutually adjacent end faces of the limit stop branches **90**, **91** also bear on one another. If, by means of actuation of the handle **87**, the lower limit stop element **84** is now pushed forward with the limit stop branches **90**, the cooperation of these with the limit stop branches **91** of the upper limit stop element means that the slide **81** of the upper prosthesis holder is also pushed forward. The two slides **81** thus move in synchrony. Since the interacting limit stop surfaces **90**, **91** are perpendicular to the longitudinal direction of the instrument, the synchronous movement of the slides **81** is ensured independently of the respective distance of the prosthesis holders from one another.

Each slide **81** carries a shoulder **95**, rigidly connected to it, and also a small block **96** which is guided on the slide, in the longitudinal direction thereof, and whose front face forms the vertebral limit stop. When the prosthesis holders, with the prosthesis plates **53** contained in them, are driven into the intervertebral space between two vertebrae, the front faces of the vertebral limit stops **96** finally bear on the ventral margins of the vertebral bodies. The distance of the front faces of the vertebral limit stops **96** from the prosthesis plates thus determines the depth to which the prosthesis plates reach into the intervertebral space. This depth can be changed by adjusting the vertebral limit stops **96** on the slides **81**. This is done by means of a threaded spindle **97** which is guided in a threaded bore of the shoulder **95** and whose end is rotatable, but connected fixedly to the vertebral limit stop **96** in the longitudinal direction. By turning the threaded spindle **97**, the operating surgeon can thus predetermine the depth of insertion of the prosthesis plates **53** in relation to the ventral margin of the associated vertebral bodies. Scale markings **98** help him to do this.

In the alternative design according to FIG. **8**, the instrument body **51**, near its front end, is connected via a pivot axis **30** to the front end of an actuating lever **31** which extends approximately parallel to the instrument body **51** and can be gripped at its rear end **32** in the manner of a forceps lever so as to be pressed toward the instrument body **51**. It has a limit stop projection **33**, or a pair of limit stop projections **33**, located on both sides of the instrument body and extending toward an opposite limit stop surface **34** on the second prosthesis holder or on a plate **73** connected to the latter. When the prosthesis holders **52**A, **52**B are not spread apart, the actuating lever **31** runs at an acute angle away from the instrument body **51**. When it is pressed toward the instrument body **51**, the limit stop projection **33** lifts the prosthesis holder **52**B in order to spread it apart from the prosthesis holder **52**A.

A similar design is shown in FIGS. **9** and **10**. The same reference numbers designate identical parts. For their description, reference can be made to the above example.

The limit stop projection **33** does not engage directly on the plate **73**, but instead on the link arm **52** which carries a limit stop pin **35** cooperating with a groove **36** at the end of the limit stop projection **33**. For cooperation with the axis **30**, an open receiving bore **37** is provided at the end of the actuating lever **31**. The function is the same as that of the illustrative embodiment of FIG. **8**. The difference lies in the fact that the engagement of the limit stop projection **33** on the oblique link arm **57** provides for a transmission, the order of which can be freely determined by the selection of the point of engagement. The design according to FIG. **9** also differs from that of FIG. **8** in that the actuating lever **31**, by virtue of the open groove **36** and the open receiving bore **37**, can be easily removed from the instrument body and can be easily coupled to it. As will be seen in FIG. **10**, the limit stop projection **33**, the limit stop pin **35**, the axis **30** and the open receiving bore **27** are provided in pairs, in order to permit a secure connection to the instrument body and to ensure that the space between the parallel guides **56**, **57** which serves for insertion of the prosthesis core is kept free from construction parts.

At the rear end **32**, the actuating lever **31** can of course be operated by hand. In addition, however, a threaded spindle **38** is provided on which the actuating lever **31** can be brought close to the instrument body **51** with considerable force by means of a nut **39** and with the aid of which the spread position of the instrument can be secured. The actuating lever **31** can also be released from the instrument body in the area of the spindle **38**.

What is clamed is:

1. An instrument set for inserting an intervertebral prosthesis, comprising:

an instrument having:

a first prosthesis holder and a second prosthesis holder, each holder being configured to receive a prosthesis plate;

a parallel guide connected to the prosthesis holders and configured to spread the prosthesis holders apart from one another; and

a prosthesis core holder configured for inserting a prosthesis core between the prosthesis plates;

wherein, the first prosthesis holder is arranged fixedly on an elongate instrument body, and parts connecting the second prosthesis holder to at least one of the instrument body and the first prosthesis holder are configured to delimit on both sides a central through-opening that extends to form a channel in a longitudinal direction of the instrument body, wherein a width of the channel corresponds at least to the transverse dimensions of the prosthesis core holder and a prosthesis core for insertion between the prosthesis plates; and wherein the parts connecting the second prosthesis holder to at least one of the instrument body and the first prosthesis holder comprise oblique link arms that are configured to form at least a portion of the parallel guide.

2. The instrument set of claim **1**, wherein the parts connecting the second prosthesis holder to at least one of the instrument body and the first prosthesis holder form a lateral guide for the prosthesis core holder.

3. The instrument set of claim 1, further comprising at least one interacting limit stop coupled to each of the instrument and the prosthesis core holder, the interacting limit stops being configured to define an end position of the prosthesis core holder.

4. The instrument set of claim 1, wherein the oblique link arms are provided in pairs and the pairs are symmetrically disposed on opposing sides of the instrument body.

5. The instrument set of claim 1, wherein the parallel guide is configured to be of a scissor-type.

6. The instrument set of claim 1, further comprising an actuating device, the actuating device further comprising:

an actuating lever having a front end, wherein the front end is mounted on one of the instrument body and the first prosthesis holder so as to pivot about an axis extending transversely with respect to the longitudinal direction of the instrument body and to the direction of spreading; and

a limit stop provided behind the axis and configured to act directly or indirectly on the second prosthesis holder.

7. The instrument set of claim 6, wherein the limit stop is configured to act on an oblique link arm connected to the second prosthesis holder.

8. The instrument set of claim 6, wherein the actuating lever is configured to be attached or released during operation of the instrument set.

9. The instrument set of claim 1, wherein a proximal end of the parallel guide is movably coupled to the instrument body and fixedly coupled to the second prosthesis holder.

10. An instrument set for inserting an intervertebral prosthesis, comprising:

an instrument body;

a first prosthesis holder fixedly connected to the elongate instrument body and configured to receive a prosthesis plate;

a second prosthesis holder connected to the elongate instrument body and configured to receive a prosthesis plate;

a parallel guide connected to the prosthesis holders such that the second prosthesis holder is connected to the elongate instrument body by the parallel guide, the parallel guide being configured to spread the prosthesis holders apart from one another and form a channel in a longitudinal direction of the instrument body; and a prosthesis core holder configured for inserting a prosthesis core between prosthesis plates received by the first and second prosthesis holders; and

an oblique link arm having a first end and a second end;

wherein the first end of the oblique link arm is mounted on the instrument body such that it is movable in a longitudinal direction thereof and the second end of the oblique link arm is mounted on the second prosthesis holder with a fixed axis, the first end of the oblique link arm being configured to be connected to an actuating device that is movable in a longitudinal direction of the instrument body; and

wherein a width of the channel corresponds at least to the transverse dimensions of the prosthesis core holder and a prosthesis core for insertion between prosthesis plates received by the first and second prosthesis holders.

11. The instrument set of claim 10, wherein the actuating device comprises a handle and a transmission device.

12. The instrument set of claim 11, wherein the handle is formed by a grip lever and the transmission device is formed by a shorter working lever connected to the grip lever.

13. The instrument set of claim 10, wherein the first end is mounted on a slide guided on the instrument body in the longitudinal direction thereof.

14. The instrument set of claim 10, wherein the oblique link arm is a member of a toggle lever pairing.

15. The instrument set of claim 10, wherein the parallel guide comprises the oblique link arm and a second oblique link arm, the second oblique link arm being mounted on the first prosthesis holder with a fixed axis and the second prosthesis holder with a fixed axis.

16. An instrument for inserting an intervertebral prosthesis, comprising:

an instrument body;

a first prosthesis holder fixedly connected to the instrument body and configured to receive a prosthesis plate;

a second prosthesis holder configured to receive a prosthesis plate;

a parallel guide coupled to each of the instrument body, the first prosthesis holder, and the second prosthesis holder, the parallel guide including a first pair of oblique link arms and a second pair of oblique link arms, the first and second pairs of oblique link arms being symmetrically disposed on opposing sides of the instrument body, and the parallel guide being configured to slide longitudinally along the instrument body to spread the first and second prosthesis holders apart from one another and form a channel in a longitudinal direction of the instrument body; and

a prosthesis core holder configured for inserting a prosthesis core between prosthesis plates received by the first and second prosthesis holders;

wherein a width of the channel corresponds at least to the transverse dimensions of the prosthesis core holder and a prosthesis core for insertion between prosthesis plates received by the first and second prosthesis holders.

17. The instrument of claim 16, wherein the parallel guide is configured to be of a scissors-type.

18. The instrument of claim 16, further comprising:

a first limit stop coupled to at least either the instrument body and the first prosthesis holder and having an end face; and

a second limit stop coupled to the second prosthesis holder and having an end face, the end face of the second limit stop bearing against the end face of the first limit stop;

wherein movement of the first and second limit stops toward distal ends of the first and second prosthesis holders results in prosthesis plates received by the first and second prosthesis holders being moved in a distal direction and movement of the first and second limit stops toward proximal ends of the first and second prosthesis holders indicates that at least one prosthesis plate is being moved in a proximal direction into at least one of the first and second prosthesis holders.

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